Repellent, irritant and toxicity effect of 20 essential oils or plant extracts on *Anopheles gambiae*

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Introduction

Laboratory and field studies showed that repellent and irritant actions of common public health insecticides reduce the man-vector contact and so interrupt the disease transmission particularly when use with long lasting treated bednets. However resistance in mosquito populations brings up the issue of finding alternative to these insecticides. The objective of this study was to evaluate the repellent, irritant and toxic effects of 20 essential oils or plant extracts on *Anopheles gambiae* adults in laboratory.

Objective

To evaluate the repellent, irritant and toxic effects of 20 essential oils or plant extracts on *Anopheles gambiae* adults in laboratory

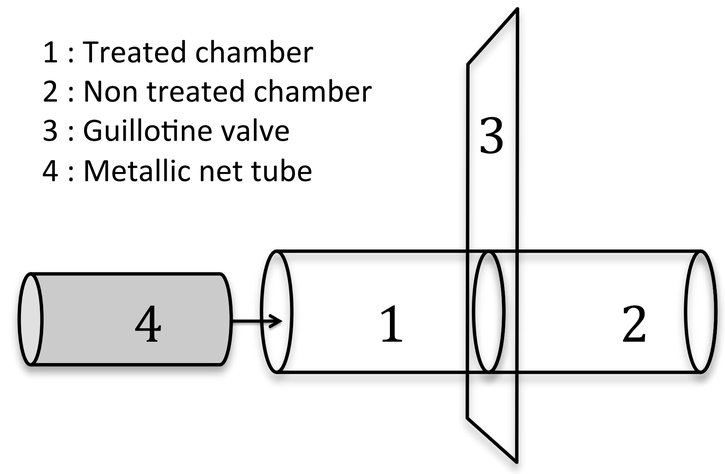
Definition

Repellent compound: causes an oriented movement away from the odour source

Irritant compound: causes an oriented movement away after contact with the product

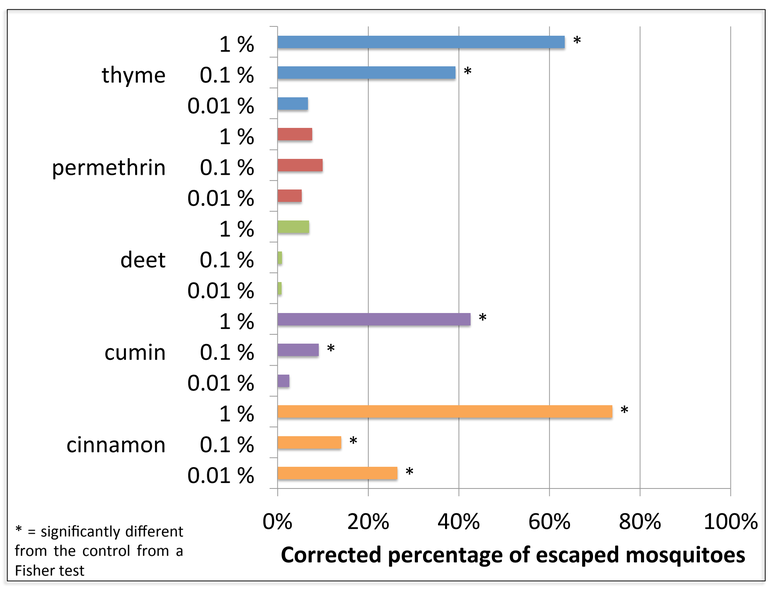
Toxic compound: causes the insect death after contact with the product

1. How to do?



- 3 replications of 20 mosquitoes placed in 1.
- **Repellent** : 1+2+3+4, 4 prevented the contact between the product and the mosquitoes
- **Irritant** : 1+2+3
- **Toxic** : 1+2, 2 was closed to force the mosquitoes to be in contact with the product

2. Are they repellent?

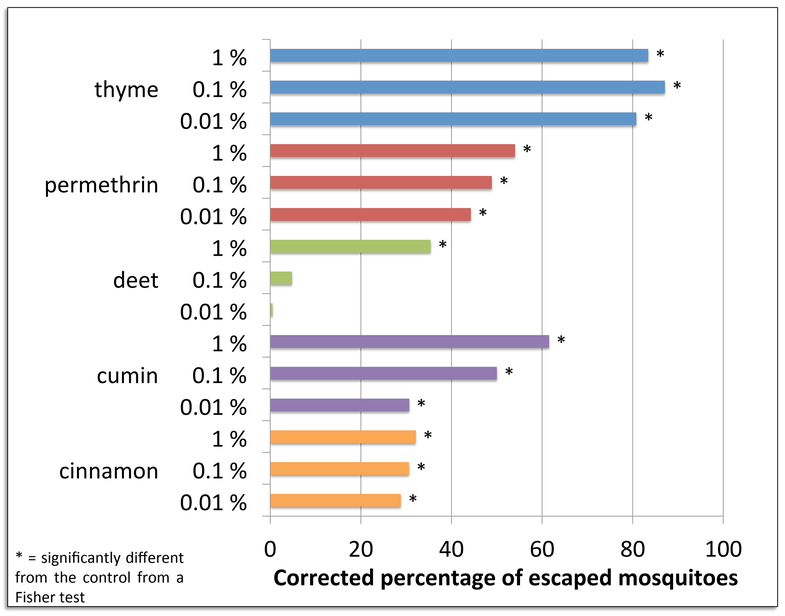


➔ Cinnamon oil > Thyme oil = Cumin oil > Permethrin = DEET

➔ Dose effect

Yes !

3. Are they irritant?

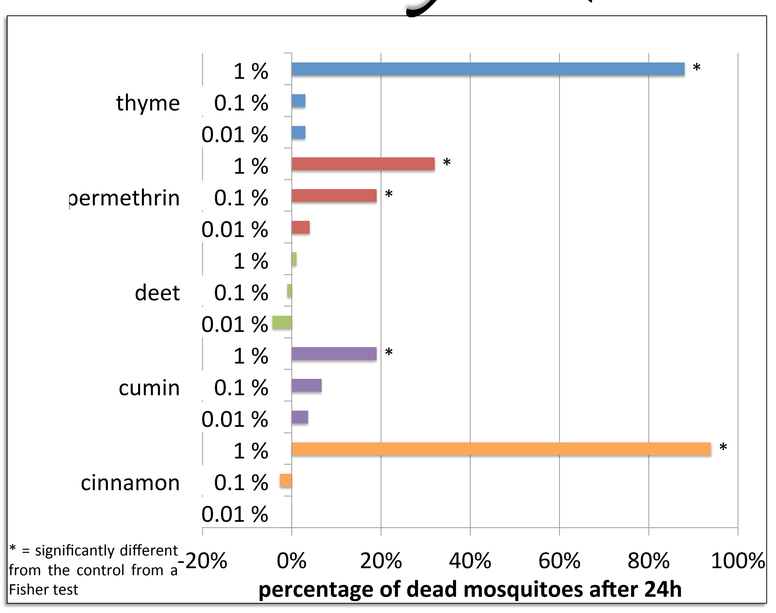


➔ Thyme oil =Permethrin = Cumin oil = Cinnamon oil > DEET

➔ Dose effect

Yes !

4. Are they toxic?



➔ Cinnamon oil = Thyme oil > Permethrin > Cumin oil > DEET

➔ Dose effect

Yes !

5. Result synthesis

Common name	Latin name	Major compound	Repellent effect	Irritant effect	Toxic effect	Extract form
DEET		DEET	0	+	0	Synthetic compound
Permethrin		permethrin	0	+++	++	Synthetic compound
Aframomum	*Aframomum pruinosum*	β-pinene	0	+	+	Essential oil
Cinnamon	*Cinnamomum zeylanicum*	cinnamaldehyde	+++	+++	+	Essential oil
Citronella	*Cymbopogon winterianus*	citronellal	++	++	+	Essential oil
Coleus	*Coleus tenuicaulis*	epoxyocimene	+++	+++	0	Essential oil
Coriander	*Coriandrum sativum*	linalol	+	+	+	Essential oil
Cumin	*Cuminum cyminum*	cuminaldehyde	++	+++	+	Essential oil
Dill	*Anethum graveolens*	carvone-apiol	++	+	0	Essential oil
Eucalyptus	*Eucalyptus globulus*	1,8 cineole	+	++	0	Essential oil
Geranium	*Pelargonium graveolens*	geraniol	0	++	0	Essential oil
Ginger	*Zingiber officinalis*	citral-zingiberene	+	+++	0	Essential oil
Lemon	*Citrus limon*	limonene	0	0	0	Essential oil
Lemongrass	*Cymbopogon citratus*	neral-geranial	++	+++	0	Essential oil
Litsea	*Litsea cubeba*	neral-geranial	+	++	+	Essential oil
Neem	*Melia azadirachta*	azadirachtin	0	0	0	Vegetal oil
Pennyroyal	*Mentha pulegium*	pulegone	0	++	0	Essential oil
Pepper	*Piper nigrum*	sabinene	++	+	0	Essential oil
Rosemary	*Rosmarinus officinalis*	verbenone	0	0	0	Biologic hydrolat
Savory	*Satureja montana*	carvacrol	0	++	+	Essential oil
Solidage	*Solidago canadensis*	germacrene-D	+	+++	0	Essential oil
Thyme	*Thymus vulgaris L.*	thymol	++	+++	+	Essential oil

➔ Citronella oil, Cumin oil and Thyme oil were the three most efficient oils for the three effects.

➔ Permethrin showed an irritant and toxic effects and Deet showed an irritant effect.

Conclusion

1. Results showed essential oils could have **irritant, repellent, or toxic** effects on *An. gambiae*.
2. The behavioral response of *An. gambiae* was **dose-dependent**.
3. But data also indicated that behavioral responses to the three effects appeared independent so we could expect that the repellent **mechanism may be different** than the irritant and than the toxic ones.

Partners :

European Society for Vector Ecology 8 - 11th October 2012 • le Corum, Montpellier, France

18e Conference

E-SOVE 2012

Prize for the best student poster

Awarded to: Emilie Delétré

For poster entitled: New method to study the repellent, irritant and toxic effects on Anopheles gambiae. Application on 20 essential oils

On behalf of the Esove 2012 Scientific Committee

at Montpellier, October 10, 2012

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